Dermal Absorption of Nanomaterials: A Critical Review of Determining Factors and Available Tools

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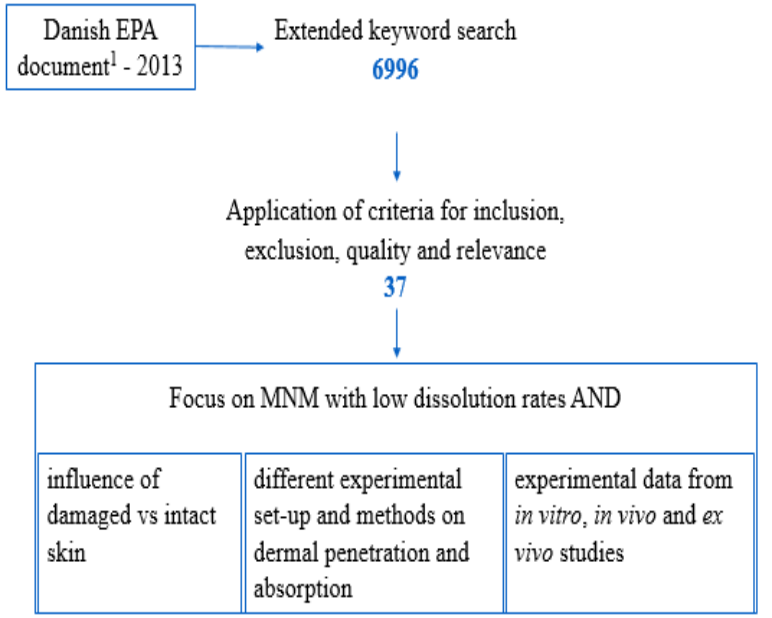
Introduction

There is concern that manufactured nanomaterials (MNM) used in consumer products and encountered in occupational settings may be absorbed through the skin. This could potentially lead to systemic availability of MNMs. For most MNMs, the extent of systemic availability as a result of dermal exposure is unclear. Therefore, this literature review aimed to identify experimental and material related factors determining the dermal penetration and absorption of nanomaterials used in consumer products and occupational settings.

Methods



Results

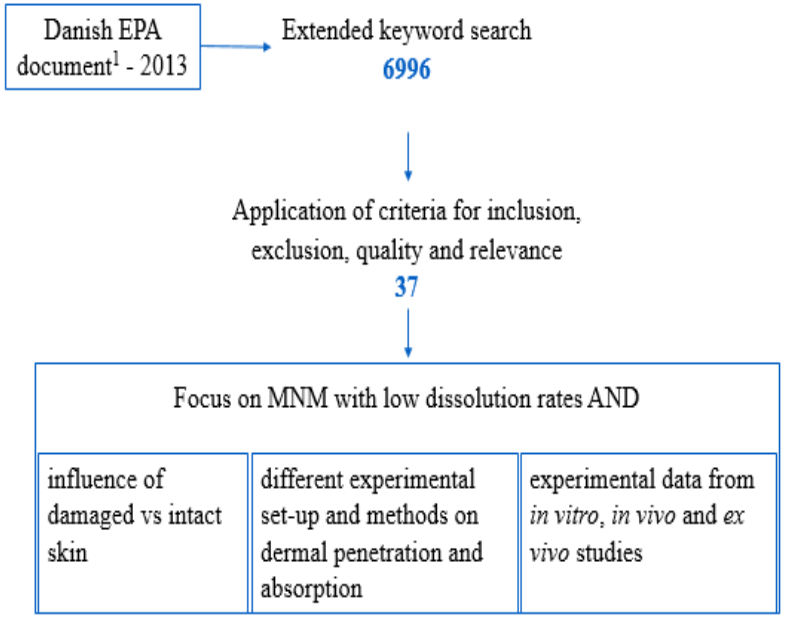
- Insufficient data of acceptable quality and relevance on dermal absorption or on the influence of specific factors
- Missing Crucial information on particle size in the exposure medium or on dissolution of the particles in many studies
- Compromised skin integrity and formulations that increase skin permeability appear to increase penetration
- Some indications were found for larger penetration of smaller particle sizes, lower penetration after agglomeration and an increase of penetration with positive surface charge of MNM

Conclusions

- Dermal absorption is at most very low for the MNMs investigated in the studies.
- Rodent skin studies were considered not very relevant
- Use of ex vivo studies with human or porcine skin to evaluate dermal absorption of nanomaterials is recommended.

References

Framework contract ECHA/2015/50 Lot 1 Specific contract no 15 - ECHA/2019/152. A critical review of the factors determining dermal absorption of nanomaterials and available tools for the assessment of dermal absorption.



Danish EPA document[1] - 2013 → Extended keyword search **6996**

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Application of criteria for inclusion, exclusion, quality and relevance **37**

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Focus on MNM with low dissolution rates AND

influence of damaged vs intact skin	different experimental set-up and methods on dermal penetration and absorption	experimental data from *in vitro*, *in vivo* and *ex vivo* studies